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ABSTRACT

The Teacher Training Institute at Hofstra University (New York), a 3-year program of inservice courses and special events of exemplary secondary school mathematics teachers. The institute was the joint effort of the Hofstra University Mathematics Department and School of Secondary Education. It was developed by a broad base of concerned educators from Hofstra University, the Nassau County (New York) Mathematics Teachers Association, and key mathematics educators from area schools, and was sponsored by the National Science Foundation. Approximately 60 teachers participated during the 2-year-long cycles (summer, 1986 through June, 1987, and summer, 1987 through June, 1988) and the capstone summer program in 1988. This booklet is the first in a series of nine and provides an overview of the origins, the development, the goals, the structure, the course of study contents, and various findings and outcomes concerning the workings of the Institute. Included in this booklet are: (1) an introduction to this series of booklets with contact information; (2) a listing of the faculty and teaching assistants, the participants, and the staff; (3) a short history of the origins and the goals of the Institute; (4) an outline of the general structure, course sequencing, and supporting activities; (5) a list of courses offered with brief descriptions; (6) a discussion of the successful outcomes and the goals attained, as well as the ideas that did not work; (7) a summary of participation statistics; and (8) appendices which contain the entrance questionnaire, the pretest/posttest form, the course and instructor evaluation form, and various news articles and announcements. (JJK)

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HOFSTRA UNIVERSITY

TEACHER TRAINING INSTITUTE

Department of Mathematics and School of Secondary Education
Hofstra University
Hempstead, NY 11550

DISSEMINATION PACKET – SUMMER 1989

Booklet #1

DAVID KNEE AND WILLIAM J. McKEOUGH
INSTITUTE OVERVIEW:
DEVELOPMENT, GOALS, STRUCTURE AND CONTENT

NSF Grant # TEI8550088, 8741127

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Hofstra University's Teacher Training Institute was a three-year program of in-service courses and special events for exemplary secondary school mathematics teachers. A joint effort of Hofstra University's Mathematics and Secondary Education Departments, this program was developed by a broad base of concerned educators and was sponsored by the National Science Foundation.

This booklet is the first in a series of nine and gives an overview of the Institute, describing its origin, development, goals, structure and content, as well as what worked and what did not.

Courses of the 12 credit year-long cycle included: The History of Mathematics, Pascal and Problem Solving, Mathematical Modeling on the Computer, Software in the Secondary Mathematics Classroom, Teaching Mathematical Concepts via Spreadsheets, Peer Workshops, and Enrichment Topics. These courses covered much that is new, neglected or soon to be introduced into high school mathematics.

Two cycles were run in consecutive years, starting June 1986. In the summer of 1988, a 'coda' component was offered. Developed in response to participants' requests, the coda rounded off the entire program. Its courses were: Calculus in the Secondary Classroom, Problem Solving via Pascal Data Structures, and Discrete Mathematical Models. Participants were

assisted in creating a dissemination activity to present to their peers after the Institute, thus multiplying the Institute's effects. Such activities included in-service workshops, talks at conferences, departmental presentations, and the creation of mathematics events for colleagues, parents and/or students.

Institute Overview: Development, Goals, Structure & Content

Booklet #1

Hofstra University's Teacher Training Institute

NSF Supported 1986-1989

Grants # TEI 8550088, 8741127

D. Knee, director Wm. J.McKeough, co-director

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Dedication

We dedicate this dissemination packet to the memory of our colleague and friend, Alfred Kalfus. Al changed the face of mathematics on Long Island and nationally.

1. Introduction

The Teacher Training Institute has been a three year program of in-service courses and special events for exemplary secondary school mathematics teachers. A joint effort of Hofstra University's Mathematics and Secondary Education Departments, this program was developed by a broad base of concerned educators and was sponsored by the National Science Foundation.

We are now winding down our work and feel that a description of our program will be useful to mathematics educators: school teachers and those studying to become teachers, professors of mathematics and mathematics education, administrators in schools, colleges, teacher centers and government. We have therefore included our experiences, our history, our structure, and our courses in this TTI Dissemination Packet, a collection of ten booklets surveying our program.

The booklets which the packet comprises are:

*Institute overview: development, goals, structure and content.

*The courses:

...The History and Development of Mathematics

...Problem Solving via Pascal

...Pascal Data Structures

...Discrete Mathematics in the Secondary Classroom

...Mathematical Modelling on the Computer

...Enrichment Topics and Problem Solving in High School Mathematics

...Mathematics Software in the Classroom

...The Spreadsheet as Device for Teaching Mathematics

...Calculus in the Secondary School

Single booklets or the entire packet are available, to interested educators, free of charge and as long as copies last. Please write to: Teacher Training Institute, Hofstra University, South Hall, Hempstead, NY 11550 or call the Institute's secretary, Mrs. Morris (516)560-5570.

2. Acknowledgments

Many dedicated colleagues in mathematics and education helped create, nourish and tinker with the Institute as it progressed, and we take this opportunity to thank them wholeheartedly.

Our planning and screening committees:
Seymour Berg, Mira Bhargava, Andrew Grant, Peter Grassi, Harold Hastings, Alfred Kalfus, Joanne Kump, Elaine Mintz, Edward Ostling, and Vincent Pane.

Institute Faculty: Joyce Bernstein, Barbara Bohannon, Ray Greenwell, Harold Hastings, Alfred Kalfus, David Knee, William J. McKeough, and Vincent Pane.

Teaching Assistants and Coaches: Janet Barbera, Joyce Bernstein, Joan Fowler, Gerald Lucchesi, Ruth Mannhaupt, Patrice McDonald, Terry Mulz, Robert Silverstone, Carolyn Walters, and Lynn Unger.

Guest Speakers: Robert Bumcrot, Mona Fabricant, Sylvia Svitak, Paul Dlug, Rudolph & Ruth Hutter, Stefan Waner, and Marysia Weiss.

Institute Participants:

Susan Alterman	Farmingdale HS	Farmingdale
Thomas Ahern	Merch HS	Riverhead
Janet Barbera	Walt Whitman HS	Huntington Station
Susan Belkin	Farmingdale HS	Farmingdale
Joyce Bernstein	Jericho Jr-Sr HS	Jericho
Hilary Bernstein	Mineola HS	Mineola
Nancy Bixhorn	Wheatley School	East Williston
Joanne Carlough	Glen Cove HS	Glen Cove
Lois Contino	Weber Jr. HS	Port Washington
Madalyn Crescitelli	Ward Melville HS	Setauket
Penelope D'Antonio	Schreiber HS	Port Washington
Karen Dowd	Nanuet HS	Nanuet
Sherryl Drasin	Long Beach HS	Lido Beach
Daniel Drance	Babylon Jr-Sr HS	Babylon
Anita Feinberg	Oceanside HS	Oceanside
William Fitzgerald	Springfield Gardens HS	Springfield Gardens
Anthony Fochetta	School of the Holy Child	Old Westbury
Barbara Folkman	Mempham HS	Bellmore

Joan Fowler	Smithtown HS-East	St. James
Herbert Friedman	Office of Home Instruction	Brooklyn
Susan Gartner		
Judith Gleicher	Huntington HS	Huntington
James Greenan	Elmont Memorial	Elmont
Arthur Hunsicker	Vincent Smith School	Port Washington
Barbara Invidiata	West Hempstead HS	West Hempstead
Denise Jaeger	Bethpage HS	Bethpage
Judith Johnson	Hempstead HS	Hempstead
Barbara Kandybowicz	Wheatley School	East Williston
John Keck	Babylon Jr-Sr HS	Babylon
Melanie Krieger	Ward Melville HS	Setauket
Michael Kucker	Office of Home Instruction	Brooklyn
Elaine Labrocca	Schreiber HS	Port Washington
Gerald Lucchesi	North Shore HS	Glen Head
John Lufrano	Valley Stream Memorial HS	Valley Stream
Marie Melillo	Harborfields HS	Greenlawn
Ruth Mannhaupt	St. Joseph by the Sea	Staten Island
Frances Marcello	Oceanside HS	Oceanside
Rosemary McComb	Long Beach HS	Lido Beach
Patrice McDonald	Massapequa HS	Massapequa
Margaret Milch	Oceanside HS	Oceanside
Teresa Mulz	Our Lady of Mercy	Syosset
Irene Ober	Half Hollow Hills	Dix Hills
Catherine Purcell	Holy Trinity	Hicksville
Edwina Richmond	York College	Jamaica
Lee Robinson	New Hyde Park HS	New Hyde Park
Richard Romeo	Edmund Miles HS	Amityville
Louise Scanlon	Valley Stream N	Valley Stream
Otto Schmidtmann	Jericho Jr-Sr HS	Jericho
Patricia Sheridan	Mt. Vernon HS	Mt. Vernon
Robert Silverstone	Great Neck S HS	Great Neck
Mary Tart	Sacred Heart Aca	Hempstead
Lynn Unger	Baldwin HS	Baldwin
John VanGastern	Hempstead HS	Hempstead
Daniel Veglia	Mahopac HS	Mahopac
Walter Vohs	Berner HS	Massapequa
Phyllis Wald	Mineola HS	Mineola
Carolyn Walters	Mt. Vernon HS	Mt. Vernon
Irwin Wolmetz	Canarsie HS	Brooklyn
Eileen Wong	Middle College HS	Long Island City

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Outside Program Evaluator: Esin Kaya

Additional Writers & Editors of the Dissemination Packet:
Janet Barbera, Joyce Bernstein, Daniel Drance, Rudolph & Ruth Hutter, John Keck, Frances Marcello, Irene Ober, Robert Silverstone, and Carolyn Walters.

The staff of the National Science Foundation.

Institute Secretary: Helene Morris

Mathematics Department Secretary: Marie Hermann

3. Planning The Institute

Planning for the Institute began in 1983. At that time, reports of commissions and study groups were clearly demonstrating a rewakening of national interest in the importance of science and math education: these reports highlighted the shortage of well-qualified mathematics teachers across the country and the lack of recognition and reward our best teachers were receiving. We wanted to focus on the latter issue and to seek ways to retain, retrain, support, and honor these exemplary secondary mathematics teachers on Long Island and vicinity.

In the fall of 1983, the Mathematics and Secondary Education Departments of Hofstra University formed a "Pre-College Mathematics Education Committee" to begin to shape solutions. Representatives joined the committee from the Nassau County Mathematics Teachers Association and the corresponding supervisors association, along with several other key mathematics educators from area schools. The form and content of the institute program was a result of this committee's deliberations, questionnaires to secondary school mathematics teachers (see appendix A) and consultations with educators throughout the Long Island region.

The involvement of Hofstra faculty in the work of the committee produced some pleasant side-effects: a new graduate-level mathematics course on the content of the new NY State "Integrated Mathematics" was developed and offered, in collaboration with the NYC Board of Education a program was produced to retrain teachers to be certified as math and science teachers at the junior high school and high school levels. These activities also served as a prelude to the Institute and we are pleased that the cooperation between the School of Education, the Mathematics Department and Secondary School Mathematics educators in creating and implementating this NSF grant proposal continues to have natural and beneficial byproducts for pre-college education and for high school/college connections.

Within a year the goals, structure, and content of the Institute were essentially completed. The Institute was designed

* to recognize and reward the outstanding achievements of carefully selected pre-college mathematics teachers.

* to to update the backgrounds and renew the

motivation of these educators through exciting courses, guest presentations, and special events, and intense work on old and new areas of mathematics and the secondary school curriculum. To have participants work with equally dedicated high school colleagues and with outstanding Hofstra faculty.

* to create an atmosphere and structure that fostered networking, cooperation, and a sense of family among participants, faculty, and staff. Group lunches were planned for the summer courses; coaches and assistants were hired from among the participants; faculty and staff were to be available for discussion and assistance, and would be open to adjustments in the program or in individual courses if difficulties arose.

* to multiply the Institute's effect by encouraging the creation of peer workshops, and other follow-through activities for participants and colleagues.

* to encourage the high school/college connection and blur the sometimes unfortunately rigid dividing line between the two, for example, by hiring qualified and interested participants as adjunct instructors at Hofstra and by encouraging Hofstra faculty to concern themselves with themes of pre-college education, give talks on such at conferences (such as NCTM and AMTNYS), etc.

The proposal ws presented to the NSF in the fall of 1984. Approval came after a little more than a year of reworking and reshaping the program with the Foundation and recruitment was begun in early 1986. Flyers were sent to secondary school mathematics departments in the area and then application forms and information sheets to those teachers making inquiries, (see Appendix F, inserted at backcover). Applicant selection was completed in May.

4. General Structure of the Institute

In the Spring of 1986 twenty-three exemplary high school teachers of mathematics were invited to broaden and update their backgrounds in mathematics, computers and mathematics education by participating in a year-long program of graduate courses and special events at Hofstra University's Teacher Training Institute. The National Science Foundation supported this program from 1986 thru 1989 under grants #TEI 8550088 and TEI 8741127.

Institute participants in both the cycles and the Coda were the "cream" of high school mathematics educators; most were from Nassau and Suffolk counties with a handful from New York City and Westchester. Almost all had Master's Degrees. Most had majored in mathematics and minored in eduction as undergraduates. Graduate degrees were mainly in secondary education, guidance, computer education, and mathematics. Other areas of undergraduate and graduate work included physics, chemistry, computer science, history, philosophy, English, and French.

Participants came strongly recommended. Many were quite active (and continue to be so) in professional organizations and educational programs such as math teacher or supervisor associations, the Long Island Math Fair, Mathletes, etc. Some had received previous recognition as exemplary teachers or had been selected to participate in other funded programs. All had some degree of computer literacy training, many had experience with Pascal and/or BASIC; for a few, this experience was quite extensive. Almost all proved to be willing, excited, persnickety, hard working, fun, and above all, very much alive.

As soon as each cycle's applicants were selected, press releases were sent to their local newspapers. Articles also appeared in Newsday, the principal regional newspaper, concerning the program. One such is included here as Appendix B.

Orientation was held in early June. Participants were warmly welcomed by Institute staff and members of the University administration. They met each other and were briefed on the program in an exciting atmosphere of collegiality.

In all, the program ran two such year-long cycles followed by a concluding summer "coda", as follows:

Cycle I	Summer 1986 thru June 1987
Cycle II	Summer 1987 thru June 1988
Coda	Summer 1988

Each cycle offered 12 graduate credits, in 3 and 2 credit courses and participants were expected to create workshops for their colleagues back at their home districts to multiply the Institute's effectiveness. Cycle courses included:

History and Development of Mathematics
Pascal and Problem Solving
Mathematical Modeling on the Computer
Software in the Classroom
Teaching Mathematical Concepts via Spreadsheets
Creating your Peer Workshops
Enrichment topics & Problem Solving in the Secondary Classroom

These courses cover much that is new, neglected or soon to be introduced into high school mathematics. The courses form a unified whole with problem solving and the various uses of the computer (programming, software, spreadsheets, computer as experimental tool, random number generation and congruence arithmetic, etc.) as common threads. The Pascal course feeds the modeling course, Software and Spreadsheets compliment Pascal, History relates to the whole curriculum by providing a setting for their content and a natural warm-up for problem solving in all the areas that will be introduced in latter courses.

Each cycle began in the summer with the "History and Development" course and in Cycle II the "Pascal" course was moved alongside History from its original position in the fall. These two courses created a sense of family and a collegial network. The participants sweated together, ate lunch together, bargained continuously with the instructors over course content and demands, and helped each other keep up the challenging pace.

In "Enrichment Topics and Problem Solving", Al Kalfus (since deceased) presented his unique approaches to probability, graphing equations using transformations, and problem-solving strategies in general along with his insights into the teaching process. This course was offered in the fall (of the second cycle) alongside the concluding segment of the Pascal course.

In the spring, Professor Hastings presented "Mathematical Modeling" wherein the computer was used as an experimental tool for exploring "what ifs" in population modeling, fractals, ecological systems and etc. Also in the spring, Professors McKeough and Bernstein offered a course in Spreadsheets as a means for teaching mathematics.

Originally, Cycle II was to have been a repeat of

Cycle I, adjusted through the experiences and feedback of the first year and doubled in size - 2 sections of 20 participants each instead of one. Unfortunately, (or so we thought at the time) only 30 participants were accepted instead of the 40 we had planned on. Since we expected some shrinkage as the year progressed, we decided to run only one section, as we had in Cycle I.

The program co-directors planned and negotiated with the NSF and the Institute participants about the best way to spend the funds that would thus be saved. We found the Foundation cooperative, imaginative, and supportive and the "coda" plan evolved, as a concluding summer follow-through program open to participants of the two cycles (and well-qualified newcomers, as space permitted).

In retrospect, we are pleased that our original plan of having two groups for Cycle II did not materialize. Having just one group kept the family flavor of the Institute and was more appropriate to our setting and our tastes. The Coda, we feel, turned out to be a much better way to spend the NSF funds. As the wise ones tell us, sometimes a crisis in an opportunity in disguise.

The coda was a 5-week program (July thru early August of 1988), consisting of three 2-credit courses under the unifying theme, "The Amazing Applicability of Mathematics". Participants chose those courses that suited their needs and tastes. The program also emphasized multiplying the institute's effects by asking participants to offer peer workshops, create new class units, give talks to colleagues and etc. based on institute content and spirit. The three courses of the Coda were:

Discrete Mathematical Models
Problem Solving via Pascal Data Structures
Calculus in the Secondary School

Discrete Mathematics was taught from the text (used with supplementary material) and video set, "For All Practical Purposes", which had happily just made its appearance that spring. Developed by COMAP under the direction of Sol Garfunkel, this text introduces a variety of wonderful topics and modern applications of mathematics to voting theory, routing problems, computers, quality control, resource allocation, etc. Several course participants have since introduced this exciting text and videos to their high school colleagues for possible use in a variety of ways.

The Data Structures course completed the Institute's Pascal sequence and enabled participants to teach the AP Computer Science course in high school. Similarly, the

Calculus course, as byproduct, enabled participants (with previous calculus background) to offer a strong AP Calculus course at their high schools.

Besides courses and special events, another important component of the Institute is multiplier-effect activities. At first, participants were expected to present an in-service training to their colleagues back at their home districts. This peer workshop would follow completion of Institute work and would help disseminate the Institute's spirit and content. But some participants chose other ways to spread "the word" and their initiatives were incorported into the formulation of Coda requirements. Participants can now:

a) give peer workshops - popular topics have been The History of Mathematics, Pascal, Fractals and Chaos, Teaching Mathematics via Spreadsheets, and Preparing Your Student for Honors and Research Work.

b) give presentations at conferences - some examples can be found in the booklets of this packet (see "Spreadsheets", "Math Modeling" and "Graphing", "Techniques using Transformations").

c) organize conferences and workshops - the K-12 Long Island computer conference called C.H.A.T., Computers Help All Teachers, was organized with the help of two of our participants in 1987 and promises to become an annual event: it has run in 1988 and 1989.

d) help initiate changes in their home departments - such as the integration of computers into the curriculum and the consideration of Discrete Mathematics as a new fourth year math elective.

e) develop and distribute new COMAP-like classroom units.

f) coach math and computer science teams, mentor honors projects, and etc.

Special events added spice throughout the Institute's three year lifetime:

*Orientation before each cycle and the coda welcomed the participants, introduced them to each other, the faculty and staff of the Institute and some of the University administrators who had helped make the program possible.

*Speakers were invited throughout the year to make special presentations in order to vary and enliven the

Institute's intense program. Topics have included: Pascal in the Classroom, Women and Mathematics, Fractals, The Autobiography of a Mathematician, Cryptography, Software for the Mathematics Class, the Theory of Cognitive Hierarchies, etc.

*A Christmas/Hanukah/Solstice Celebration took place at the end of each fall semester.

*Graduation ceremonies concluded each cycle and were lively affairs of well-deserved congratulation, completion and certificate-bestowal.

*"Math Day at Hofstra" was conducted in April 1989. Participants were invited to bring their talented and interested students to Hofstra for a day of mathematics lectures, lunch and planning for more such special events to be offered during the Fall and Winter of 1989.

*A Reunion and Mini-Conference took place in May 1989. Professor Stefan Waner of Hofstra's Mathematics Department presented a discussion-provoking talk, "Levels of Abstraction, Quantum Learning Theory, and the Pleasure of Graphing a Notion". Small groups were formed to discuss the issues of teacher training and K-12 curriculum. See Appendix E for materials used.

*We are planning an experimental collaborative mini-course, "Number Theory and the Computer" for the fall of this year. Institute participants will invite their exemplary students to join them in a series of Saturday workshops to learn number theory, and work on projects involving theory, programming, and spreadsheet applications.

5. Institute Courses

Below is a listing of Institute courses and a brief description of their contents:

Cycle Courses

History and Development of Mathematics - The flow of mathematics is followed from pre-history to the present, paying due attention to the modern era, women in mathematics, minority and non-Western contributions, and development in the U.S. The course is content-oriented in that students will work with the mathematics of the period they are studying. Team presentations to class are required.

Text: Burton, David History of Mathematics, An Introduction, Allyn & Bacon

Problem Solving via Pascal - Heuristics, discovery and pattern recognition are encouraged to solve problems through the medium of the programming language, Pascal. Programming and mathematical techniques and concepts such as arrays, procedures, functions, records, mathematical induction and recursion are covered. Applications to the classroom.

Texts: Cycle I - Dromey, R.G. How to Solve It by Computer, Prentice-Hall
Lecarme & Nebut Pascal for Programmers, McGraw Hill

Cycle II- Cooper & Clancy Oh! Pascal, Norton

Enrichment Topics and Problem Solving in High School Mathematics - Graphing equations using transformations, problem-solving techniques, probability, mathematics contests and fairs, topics for high school student research papers.

Mathematical Modeling on the Computer - Using the computer as an experimental device with topics taken from: population models, random number generation and testing, probability, sorting, fractals, matrix models.

Software in the Classroom - Exploration of programs and software (including public domain) for possible secondary classroom use, the spreadsheet as a device for teaching mathematics, creating your Peer Workshop.

Coda Courses

Discrete Mathematical Models - Basic theory and an introduction to the many and diverse applications of graph theory, combinatorics, probability and statistics, linear programming, voting paradoxes, and codes.

Text and Video Set: Garfunkel, Solomon (project director) For All Practical Purposes, Intro to Contemporary Mathematics, COMAP, W.H. Freeman

Problem Solving thru Pascal Data Structures - A brief review and then continuation of the cycles' Pascal work that includes debugging and testing a program, stacks, queues, lists, trees, graphs, sorting, searching and advanced programming projects.

Text: Dale & Lilly Pascal Plus Data Structures, Heath

Calculus in the Secondary Classroom - For participants with background in calculus. A review and deepening of basic theory, applications, problem solving, and classsroom ideas. Limits, continuity, differentiation, integration, graphing, areas, etc.

Texts: Hockett, Shirley How To Prepare for the AP Placement Exam in Math, Barron
Any standard calculus text (e.g. Anton, Thomas & Finney) as reference.

6. What Worked & What Didn't

Perhaps the greatest success of the Institute was the tremendous amount of learning that took place. Participants became expert Pascal programmers, got an overview of the development of mathematics from the notched Ishango bone to the day before yesterday, learned contemporary techniques for modelling natural processes on the personal computer, explored and experimented with fractals, software, problem solving, issues in education, and more. Some few participants came to the Institute already well advanced in one or more of these areas - we had chosen our participants from among the exemplary members of their profession. These volunteered to be coaches for the rest. For the most part teaching, coaching, being a student again, forming a supportive network of colleagues were all done and received excellently.

Our greatest failure was the unstructured, anxiety-producing manner we started the Pascal portion of Cycle I. We had advised participants to use the summer to refresh their knowledge of Pascal or to start their study of it. The Pascal texts were ordered early and the coaches were prepared to provide extensive assistance. The Institute's summer courses, however, required most of the participants' attention so this informal approach just didn't work. Most of the initial stages of Pascal had to be incorporated into the fall course instead. This created a sense of having to catch up and of being overwhelmed that sometimes understandably turned excitement into apprehension. Another source of participant discomfort came from planning courses that were too rich in content and goals. For example, the "History & Development" course was to create a context for participant knowledge, serve as a problem-solving warmup, cover the highpoints of both ancient and modern mathematics, present several guest speakers, present a guest intructor's point of view, exercise both individual and team efforts, touch on special themes such as Women In Mathematics, Mathematics in the USA, new areas of Mathematics in the NY State curriculum, etc. These are all worthy goals but too much to be realized within one course. We apologize for these discomforts, especialy to those participants who didn't finish Cycle I due to these lapses in our judgement.

For Cycle II we entirely (and successfully) reworked our approach to Pascal. From one (3 credit) course in the fall semester preceded by an informal summer introduction via coaches and self-study, we lengthened and formalized the course into three segments as follows:

1. a pre-institute one-week introduction to Pascal (one in-service credit recommended) for those who wished to brush up. (Most did.)

2. the main body of the course, presented during the regular five week summer session (2 credits).

3. more advanced and complex programming projects spread out during the fall (1 credit) at approximately one meeting per month.

In general, Cycle II profited from our Cycle I experience, mainly in the graded and clearer way Pascal was now introduced. Also, in response to participants' recommendations that secondary school educators play a larger role, Professor Alfred Kalfus was invited to join the Institute faculty for Cycle II. Professor Kalfus (recently deceased) was a dynamic force in mathematics education on Long Island, nationally and internationally. High school mathematics teacher and chairman, college professor, much honored innovator and speaker, Al had trained many of Long Island's finest teachers, founded the Long Island Math Fair and Mathematics Leagues, and published many papers on problem-solving, graphing techniques and issues of mathematics education. A fuller description of Al's many accomplishments will appear in a later booklet of this dissemination packet. He had been a guest lecturer for the History course in Cycle I: now as faculty member, he contributed more to the History course during the summer and continued with his own course during the fall.

Another adjustment for Cycle II was that what had been an extra 1 credit course (spreadsheets in the teaching of mathematics), offered at the request of the participants at the end of Cycle I, became the main focus of the "Software in the Classroom course of Cycle II.

Pre and post-testing had started out being a necessary evil, an unwelcome intrusion needed to satisfy the NSF's need for program evaluation data. In Cycle I, we began each course with a pre-test and concluded with a similar post-test. For Cycle II, however, the pre-tests were combined into one hour long test, given on the first day of the History class. Post-tests were administered as part of the final of each individual course (see Appendix C). Participants were assured this test would not count in their grade, that it should be considered a "coming attractions" for the year's work ahead, that if there were many questions they found difficult or inpenetrable this indicated they had come to the right place. They would be learning lots and would be pleased at how simple these same kinds of questions would appear as the institute

progressed.

At the end of each course, when the questions reappeared on the final, the students could directly experience how far they had come. Test results throughout the Institute (see section 7) indicated that much learning had taken place and were a source of pride both for faculty and participants. In general, Cycle II ran much more smoothly and without the sense of excessive requirements and unrealistic assumptions that had been felt in Cycle I.

The Coda profited from the expereiences of both cycles: we had learned how to maintain intensity, involvement, and excitement, yet steer clear of the anxiety resulting from content and requirement overload. We encouraged participants to register only for those courses they were interested in and felt they could manage. Also, responsibility had been shared with participants in planning the courses of the Coda and in expanding suggested methods of multiplying the institute's effect. In short, we retained in the Coda what had worked in the cycles (group lunches, use of coaches, open channels of communication, family atmosphere, pre and post-tests, etc.) and had added new features to continue improving our program.

Course & teacher evaluations (see Appendix D) were another useful line of communication avidly read at the end of the term by the instructors and co-directors and then sent on to the outside program evaluator. During the summer portion of the program, participants and staff had lunch together and this also was a forum to air grievances, express frustrations, share excitement, chat about a project underway or approaching tests. During Cycle I, the director attended all classes and continued to attend periodically during Cycle II and the Coda. The Institute's lines of communication were well oiled. Some course projects were collaborative, study groups and coaching were encouraged, Cycle I participants were invited back for Cycle II courses and special events, all participants were invited to attend follow-through events and to keep in touch, some participants started teaching as adjuncts in the Hofstra Mathematics Department. So a sense of community, network and natural feedback developed quickly and remained intact throughout the Institute and continues even now though classes have been over since August 1988.

We feel that our Institute was generally successful in its goals of honoring, rewarding, inspiring, and updating the education of our groups of exemplary mathematics teachers. We hope the reader who is interested in teacher education will consider our choices

of content and structure. We point out that much of our content is still valid if adapted to other levels and circumstances. For example, we feel strongly that historical perspectives enliven teaching and serve as a setting for mathematics content at all levels. The use of hand-held calculators and even computers makes sense also at all levels, as does problem-solving with a sense of exploration, seeing the variety of applications of mathematics, and experimenting with collaborative work: student team projects, peer teaching (students with students, teachers with teachers), student/teacher team projects (we hope to experiment with such a mini-course this fall as our last Institute follow-through event), high school faculty/college faculty intermixing. For us also, small was beautiful. Everyone knew everyone and this helped create a satisfying family atmosphere and a high level of performance by faculty, staff and participants.

Lively and important issues in teaching are presently being seriously investigated by educators, cognitive scientists, teachers of writing, mathematicians and psychologists. Some examples are: enlisting parents more fully in their children's progress, collaboration among students, exploration of open-ended problems, the use of writing in mathematics, presenting historical perspectives, introducing topics of Discrete Mathematics. There is much material here for worthwhile grant proposals. The Institute has been a wonderful experience for us and working with the NSF has been exciting and worthwhile. We invite our readers to take advantage of the opportunities the preseent crises and openings in education provide.

7. Numbers

Cycle I 1986-87, n=total number of particips=23

	Number of Course Participants
History (Summer '86)	23
Software (Summer '86)	23
Pascal (Fall '86)	19
Modeling (Spring '87)	13
Peer Workshop (Spring '87)	12
Spreadsheets (June '87 Optional)	15

Cycle II 1987-88, n=30

		Pre-test Mean Score	Post-test Mean Score	Factor of Improvement
Intro to Pascal (June '87 Optional)	24	--	--	--
History (Summer '87)	27	17	88	5.2
Pascal (Summer & Fall '87)	27	34	91	2.7
Enrichment (Fall '87)	39*	30	44	1.5
Modeling (Spring '88)	18	47	79	1.7
Spreadsheets, etc. (Spring '88)	19	29	89	3.1

Coda Summer 1988 n=32

Discrete Mathematics	22	37	90	2.4
Pascal Data Structures	19	11	61	5.5
Calculus	23	61	96	1.6

The fourth column, Factor of Improvement, is the ratio of columns 3 and 2. All pre and post test mean scores have been scaled to 100%=perfect score.

In the Coda, participants chose from among the three courses offered, while in the Cycles, all participants were expected to take all courses (total of 12 credits) with two exceptions:

a) the Spreadsheet course of Cycle I, was an optional new offering (1 credit) created at the participants' suggestion and then incorporated into the curriculum the following year.

b) Introduction to Pascal in Cycle II was an optional one week pre-institute course.

Neither of these exceptions had a pre/post test.

The "Enrichment" course of Cycle II includes ten participants from Cycle I.

The pre/post tests of Cycle I consisted of similar but different questions, and grades are not included here. Our outside evaluator, Dr. Esin Kaya, explained to us that comparison of grades on two different sets questions would be highly subjective. The Institute faculty's impressions are that learning in Cycle I was tremendous, and very much like that indicated by the Cycle II results given here.

The "Spreadsheets, etc." course of Cycle II combined what were three segments of Cycle I - Spreadsheets, Peer Workshop and Software.

HOFSTRA UNIVERSITY HEMPSTEAD, NEW YORK 11550

Departments of Mathematics & Secondary Education
Teacher Training Institute

December, 1983

We are in the midst of creating a program of seminars for Nassau County high school teachers which we hope will be funded by NSF. We need your input. Tentatively we envision 3 different seminars offered in the successive semesters of the 1984-85 (plus summer) academic year. Participants would choose only those seminars whose mathematical and pedagogical content suited their needs and would return to their schools, not only enriched themselves, but with the ability to hold workshops for their colleagues.

Answer the questions as if you were going to participate in the program. Feel free to embellish your answers with specifics and related points that occur to you. Use the back of the questionnaire.

Sincerely,

David Knee

David Knee
Project Director

DK/lac
Enc.

High School _____ Position _____

1. What mathematical content should the various seminars deal with?

2. What pedagogical areas should be stressed?

3. If fall and spring seminars met for about 3 hours per week, which would you prefer:

   a. ☐ 1 day a week, 3 hours with a dinner break (possibly free) to chat, relax, and discuss class.

      ☐ 2 days a week, 1-1/2 hours each session.

   b. ☐ weekdays

      ☐ weekends

   c. ☐ specifically which days and times:

4. Would you like a summer session?

   ☐ 6 weeks

   ☐ 3 weeks but intensive

5. What degrees, credentials, etc. do you need for your own pesonal advancement and/or to become a better teacher?

6. Your present status

   a. present degree(s):

   b. certification status:

7. Have you attended any other training institutes?

   which?
   when?
   what areas did you study?

8. Should we offer graduate credit to seminar participants?

   Would undergraduate credit be of any interest to you?

9. What else could make an Institute at Hofstra particularly desirable?

10. Would you be interested in being a participant?

11. As our plans develop, are you interested in receiving furher information?

Name _____ Address _____

NEWSDAY SATURDAY 8 MARCH '86

Math Teachers to Vie For Honors Workshop

By Sid Cassese

Long Island's best mathematics teachers are expected to compete for 20 slots in a National Science Foundation honors program at Hofstra University this summer.

The Honors Workshop Program for Exemplary Teachers of Mathematics "will reach out to Long Island's best," said William J. McKeough, a professor of secondary education, "first, to honor them; then, to help make them even better than they are already, and finally, to help them help their peers through in-service workshops at their schools."

As a part of the innovative program, teachers would be required to pass along their new skills to other teachers by conducting workshops in their own schools. In addition, Hofstra would send two of its professors to help with in-service workshops.

The project, funded for $84,142 in the first of a three-year continuing grant, is among about 50 funded nationally under the National Science Foundation's Leadership Activities for Pre-College Teachers Program, the NSF's Larry Hatfield said yesterday in Washington. The NSF education program was killed by the Reagan administration in 1980, but restored by Congress four years later.

"We see these teachers returning to their schools to engage in leadership activities," he said. "The model would be to expect at least five of their peers to be influenced by the leader teacher. And in this ripple effect, we are hoping to improve science and mathematics teaching at the pre-college level."

Under the program, teachers would earn 12 graduate-course credits, learning such subjects as the use of computers in problem solving, the development of modern mathematics and probability and statistics.

Applicants must be recommended by their supervisors and administrators as exemplary teachers. Teachers are expected to come from Nassau, Western Suffolk and Eastern Queens. "We also will be making a special effort to reach out . . . minorities and women," said McKeough, who is co-director of the program with mathematics professor David Knee.

Science and math teachers have been in short supply for nearly a decade, for reasons that include the difficulty of the subject, faculty cuts by seniority rather than subject, and competition from business, McKeough said.

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TEACHER TRAINING INSTITUTE
Cycle II: Summer 1987-Spring 1988

PRETEST

NAME _____

PART I

In questions 1 & 2, 'identify' means give two biographical items such as dates, accomplishments, country, biographical tidbits.

1. Name and identify three (3) women mathematicians.

2. Identify each of these mathematicians:

   Eudoxus

   Liebniz

   Gödel

   Lobachevsky

3. Verify that 496 is a perfect number.

4. Identify/define each of these items briefly:

golden ratio

Goldbach conjecture

Playfair's axiom

fractal

duplication of the cube

PART II

1. Define an "infinite" set.

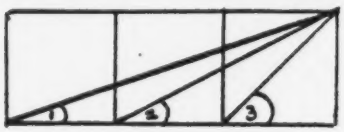
2. Name two non-Euclidean geometries, and explain briefly how they differ from Euclidean Geometry.

3. Derive a formula for the sum:

$$1+3+5+\ldots+(2n-1)$$

4. The graph of $f(x) = x^3-3x^2+3x$ is symmetric in a point. Find the coordinates of that point.

5. Given three adjacent unit squares, as shown, prove that $m\angle 1 + m\angle 2 = m\angle 3$.



6. Sketch the graph of $|x-2| + |y+4| = 3$.

PART III

1. Identify at least two (2) ways in which random-number generators are used in software designed for the secondary level mathematics education market.

2. Describe (briefly, yet tersely) how a secondary mathematics teacher might use a spreadsheet to

   a) stimulate students' critical thinking; and

   b) enhance or expand the teaching of functions.

3. State at least three (3) ways in which microcomputers' floating point representation of real numbers fail to satisfy the definition of a field.

4. Discuss (succinctly, yet cogently) the cases for and against teaching the GOTO construct in microcomputer BASIC.

PART IV

1. A coin is tossed and comes up heads 5 times in a row. Would you expect heads or tails next time? Why or why not?

2. Let p:191 (prime), let a:17, and let x be an integer in the range 1,2,...191. Suppose the instruction PLOT (y,z) plots the point (y,z) on a screen. Write a program which starts with x:1, updates x using the formula x_{new}:a*x mod p, plots the ordered pair (x, x_{new}), then replaces x by x_{new}, and continues for 500 such pairs.

3. You are using a computer to estimate the derivative of the function $y=e^x$ near $x=0$ by evaluating the quotient

$$\frac{e^h - 1}{h}$$

for small h. For h about 10^{-4} there are good results, but $h=10^{-8}$ gives an answer of 0. Briefly explain why.

4. Consider the population model $x_{new}=2x(1-x)$, where x is the relative population with $0<x<1$. Is there a stationary value of population (a value of x with $x_{new}=x$)? If so, call this value x_{eq} and consider a program which starts with $x=x_{eq}+0.1$ and computes several successive x-values. Describe the output of this program.

PART V

Questions 1 and 2 are based on a program with the following structure:

```
program A;
  procedure B;
    procedure C;
    begin
      ...
      C;
      ...
    end;
  procedure D;
    begin
      ...
      B;
      ...
      B;
      ...
    end;
begin
  ...
  D;
  ...
end.
```

1) A variable that is declared in procedure B and only in procedure B is accessible in

☐a) all of program A

☐b) procedure B, but not in procedures C and D

☐c) procedures B and C, but not in procedure D

☐d) procedures B and D, but not in procedure C

☐e) procedures B, C, and D, but not elsewhere in A

2) Suppose that the program A contains no **goto** statements and no procedure calls other than those indicated. Which of the following lists describes completely the order in which the procedures contained in program A are called or invoked?

☐a) D, B, C

☐b) B, C, D

☐c) C, B, B, D

☐d) D, B, B, C

☐e) D, B, C, B, C

3) Which of the following statements, when used as the body of the function definition **function** Fact(n:integer) : integer;

```
begin
  .
  .
end;
```

will enable that function to compute n! correctly for any n > 0, where n! = n*(n-1)*(n-2)* . . .*3*2*1 ?

I. Fact := n*Fact(n-1)

II. **if** n < 2 **then** Fact := n
else Fact := n*Fact(n-1)

III. **if** n = 1 **then** Fact := 1
else Fact := Fact(n+1)/(n+1)

☐a) I only

☐b) II only

☐c) I and II only

☐d) II and III only

☐e) I, II, and III

4) What output is produced by the following program?

```
program ABC(input, output);
    var n: integer;

    procedure Increment(var a, b: integer);
    begin
        a:= a+1;
        b:= b+1
    end;

    begin
        n:= 3;
        Increment(n,n);
        write(n)
    end.
```

☐a) 5 ☐b) 4 ☐c) 3 ☐d) 0 ☐e) An error message

5) Suppose that the variable d represents the number of dollars in a bank account after interest has just been credited to that account (e.g., d = 123.456). Which of the following Pascal expressions would round that amount to the nearest cent (e.g., to 123.46)?

☐a) round(d/100)*100

☐b) round(100*d)/100

☐c) round(d/100)

☐d) round(100*d)

☐e) round(d)

HOFSTRA UNIVERSITY
Teacher Training Institute
Spring, 1988

COURSE AND TEACHER EVALUATION
Questionnaire

The Institute would appreciate your considered and honest response to this questionnaire.

Below is a list of questions concerning your impression of the course and the instructor. Answer each question by circling the letter which corresponds most closely to your judgement. The extremes are defined as indicated.

The course is ___

The instructor is_____

		A	B	C	D	E	
1.	The instructor's daily presentation is	(well organized)					(disorganized)
2.	The ability of instructor to transmit information is	(excellent)					(poor)
3.	The instructor's knowledge of the subject matter is	(outstanding)					(inadequate)
4.	Does the instructor see to it that the classroom situation is conducive to questioning?	(very much)					(not at all)
5.	The answers the instructor given to student's questions are	(excellent)					(poor)
6.	If a student asks a question, is the instructor concerned with whether or not the student understands the explanation the instructor gives	(very concerned)					(unconcerned)
7.	Outside of class the instructor is	(available)					(unavailable)
8.	Does the instructor stimulate interest in the subject matter?	(very much)					(not at all)
9.	Would you recommend that a friend take a mathematics course from this instructor?	(definitely)					(never)
10.	What is your perception of the amount of mathematics you are learning in this course?	(a lot)					(little)

		A	B	C	D	E	
11.	The tests are	(too difficult)					(too easy)
12.	From taking the tests I learn	(a lot)					(nothing)
13.	The grading is	(too harsh)					(very lenient)
14.	Are the homework problems assigned helpful in learning the course material?	(very helpful)					(not helpful)
15.	The amount of homework assigned is	(too much)					(too little)
16.	Does the instructor provide you with a means to judge your progress in the course (for example, corrected homework, frequent quizzes or tests, etc.)?	(yes)					(no)
17.	With respect to other college level instructors, I would grade this instructor						
18.	Including the homework, how much studying do you do for this course <u>per week</u> outside the classroom						
19.	Class attendance during semester	(always came)					(never came)
20.	What is your grade so far in this course?						
21.	Usefulness of course						

22. The following strengths impress me most about this instructor:

23. The following weaknesses are evident to me about this instructor:

24. Please make any other comments about this course, the instructor, the Institute or this evaluation questionnaire:

May 1989

Hofstra University
Teacher Training Institute

REUNION & MINICONFERENCE
Thursday, May 11, 1989
at 4:30PM
in Room 106 Davison Hall

Program

* Professor Stefan Waner will speak on
  "Levels of Abstraction, Quantum Learning
  Theory,and the Pleasure of Grasping a Notion"
* Brief update on recent and future TTI activities
* Buffet Supper: Cold cuts, salads, etc.
* Small group discussions on weighty issues

We need facilitators and recorders for the group discussions. Please volunteer when you RSVP. You are welcome to invite interested colleagues to attend our festivities with you.

Yours,
David & Bill
David & Bill

RSVP, if you have not already done so, to Ms. Helene Morris, 560-5570.

May 11, 1989

HOFSTRA UNIVERSITY
Teacher Training Institute
Reunion & Miniconference

Small Group Discussions

FACILITATOR

1. Read the question aloud and invite the group to air their views.

2. Redirect the group to the issue if it strays too far for too long.

3. Direct "traffic" so that everyone gets a chance to have their say.

4. Take care that neither you nor any one else monopolizes the discussion.

5. About 25 minutes for discussion and then 10 minutes to form summary statement. Be sure that everyone's views are accurately reflected in this summary.

RECORDER

1. Take notes of the discussion.

2. During last 10 minutes help the group shape an accurate final summary statement (1 paragraph, 1/2 page or longer).

3. Represent your group when we all reconvene by reading the question and your group's summary statement.

4. Leave your notes and your phone number with David or Bill so they can report on this miniconference in the Dissemination Packet.

May 11, 1989

HOFSTRA UNIVERSITY
Teacher Training Institute
Reunion & Miniconference

Questions for Group Discussion

A. The Teacher Training Institute is in the process of completing its Dissemination Packet for distribution to participants, to NSF and to other interested educators. Also, David will be attending an NSF workshop for project directors in 3 weeks. What advice can we give these mathematics educators about future "Teacher Enhancement" projects with regard to content and form? What kinds of programs should the government be funding in the future, at what educational leavels? How should they be set up, what should they offer, what should they avoid?

B. Recently, the appearance of NCTM's "Standards" and NRC's "Everybody Counts" points to a new era in mathematics education which emphasizes thinking over rote learning, collaboration over competition, connecting mathematical concepts to the experiences of everyday life, and includes probability, statistics, discrete mathematics and the use of calculators and computers even at the elementary school level.

   * Can this new approach work or is it just another pipe dream reminiscent of the ill-fated New Math of the 60's?

   * How well aligned is NYS Sequential Math High School curriculum with "Standards".

   * What needs to be done to smooth the implementation of "Standards" and "Everybody Counts"?

Both these questions are very broad so feel free to focus on any part or parts of them.